**Workshop on Sustainable Intensification Indicators**

AAAS Annual Meeting Workshop San Jose, California

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**Workshop Goals**

*Gordon Conway, Meeting Chairman*

Growing populations, rising urbanization, and changing diets necessitate higher, and improved, food production around the world. At the same time, increases in production must be considered in terms of constraints in land and water. Sustainable Intensification (SI) works towards achieving agricultural production needs on the same or less amount of land in order to conserve resources while benefiting smallholders.

The goal of this Sustainable Intensification Indicators workshop is to discuss and develop indicators and metrics within the already established SI framework domains: productivity, economics, environment, social, and human. Focusing on any one of them will bring tradeoffs, and so they should aim to minimize those tradeoffs while remaining practical and easy-to-measure. Today’s workshop is structured for participants to define high level, qualitative indicators and their quantitative metrics: “Today is about demonstrating that we can do this. Then we can apply it,” Gordon said.

**Overview: Steps for developing the SI Assessment Framework**

**Iterative Process Steps**

Across four meetings, participants began to:

1. *Define framework terminology:* Are domains the correct way of thinking about indicators areas?
2. *Define measurement levels:* political or ecological?
3. *Define minimum measurement guidelines:* What are strong indicators that are easily measured at low costs? What is the appropriate unit of analysis per domain?

*Jerry Glover*

In 2013, various donors and implementers met in Accra, Ghana to catalyze the development of a measurement framework for Sustainable Intensification that links farm-level and population-level impacts. “Rather than assuming a trickle-up affect, a logical projection of smallholder change from food insecurity and troubled livelihoods towards population change is needed,” Jerry outlined.

The first meeting in Accra led to four successive meetings to debate, finalize, re-think, phase out, and re-integrate framework components and indicators. Since 2013, a total of four iterative meetings took place, all with different and diverse participants, to identify numerous measurement challenges and solutions. For example, at what scales does measurement for SI need to take place? What are best practices for establishing indicator characteristics? What are the minimum indicators needed to measure SI?

The discussions resulted in a draft SI framework consisting of five “domains” across four “scales.” The domains include: 1) productivity; 2) economic; 3) environment; 4) social (inclusive of gender); and 5) Human (inclusive of nutrition, food security, education). The scales include: 1) field/plot level; 2) farm-level; 3) household level; and 4) a macro-level zone of influence. (See table 1 below.)

The goal of this fifth workshop is to further developed indicators within the previously established scales. It is also to develop rationales for why any given indicator is an appropriate gauge for sustainability. Indicators should be practical, cost effective, and include foci on nutrition, gender, and natural resource management.

**Table 1. Draft Sustainable Intensification Framework, January 2015**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Field/plot | Farm | HH | Zone of influence |
| **Productivity** | | | | |
| - Crop Yield |  |  |  |  |
| - Yield variability |  |  |  |  |
| - Livestock yield |  |  |  |  |
| **Economic** | | | | |
| - Gross Margin |  |  |  |  |
| - Gross margin variability |  |  |  |  |
| - Total factor productivity |  |  |  |  |
| **Environment** | | | | |
| - Soil quality |  |  |  |  |
| - Veg cover |  |  |  |  |
| - Water prod |  |  |  |  |
| - Nutrient prod |  |  |  |  |
| - GHG emissions |  |  |  |  |
| - Nutrient balance |  |  |  |  |
| - Biodiversity |  |  |  |  |
| - Soil organic matter |  |  |  |  |
| - Soil conservation |  |  |  |  |
| **Social** | | | | |
| - Gender equity |  |  |  |  |
| - Education/training |  |  |  |  |
| - Social connectedness |  |  |  |  |
| - Underserved (land tenure and security) |  |  |  |  |
| **Human** | | | | |
| - Nutrition |  |  |  |  |
| - Food security |  |  |  |  |
| - Labor |  |  |  |  |

The draft framework (Table 1) as of January 2015 reflects the following key discussion points:

* The framework is **not** intended to define or quantify ‘sustainability’ or pre-determine an ultimate state of sustainability or specific practices that lead to sustainability, but rather to guide decision making, based on evidence-based outcomes, resulting in agricultural systems with improved productivity, environmental, social, and economic outcomes.
* It is **not** intended to cover all dimensions or scales of sustainability but only those commonly focused on by agricultural R&D projects, and it is intended be amendable to the development of standardized methods but flexible enough to be adaptable to different scales of interest.
* It is **not** intended to replace other frameworks used by individual programs or projects, but rather to provide a simplified, common framework that facilitates cross-program learning and assessment.
* Household and productivity data for understanding livelihoods are at the crux of many discussions. The house hold scale captures off-farm livelihood activities while the plot and field levels capture productivity.
* High level zones of influence are difficult to define across stakeholders; it varies among communities, administrative or political districts versus watersheds or ecological boundaries).
* The characteristics of quality indicators needs to be discussed in relation to SI. Indicators must balance out robustness versus ease of measurement.
* The SI measurement framework is a decision making framework to improve probability of success for farm and farmer level impact. It must be realistic for donor investment and practitioner needs.

*Group Discussion:* Do the scales represent measurement needs for SI, and what is the definition for Zones of Influence?

* Not all measures may aggregate towards a more macro-level zones of influence (linkages between field and community/regional zones of influence are often difficult).
* Measures for field level are not always relevant or practical, and there is no standard for measuring productivity. It is important to get that correct before considering higher-level zones of influence.
* However, there are important drivers of change at the higher-level zones of influence that affect farm-level, including for natural resources management.
* Ultimately, a balance needs to be struck between the flexibility of the scales and logical connection between scales.
* The group decided to focus on the micro scales and address the higher-level zones of influence as appropriate/logical while defining metrics in small groups.

**Presentation: Literature review on indicators & metrics** **in SI**

*Peter Thorne & Sieg Snapp*

In 2014-15, a literature review was conducted to examine current SI measurements. The review found that there is a lack of uniformity among researchers for SI indicators. A framework may need to be flexible to varying project, crop, and environmental contexts and be supportive of spatial and temporal variability. A potential way to address context is to build metrics that are both static and longer-term.

*Group Discussion:* What already existing indicators and metrics are most useful for SI?

* There are many examples of measurements that are easy, but that are not being used, or that are being used in specific disciplines (e.g. health and nutrition indicators).
* One indicator cannot cover all domains, but many indicators can capture impacts that are occurring across domains.
* The framework must quantify the tradeoffs for making decisions for advancing SI, and therefore focus on pragmatic indicators and metrics.
* It is important to think *systematically* about how indicators might come together. For each, we need to drill down what are the appropriate metrics.
* The group agreed to test out a series of metrics during the “flash fill” exercise to discuss and drill down on potential indicators.

**Indicator Development 1: “Flash fill” exercise**

*Jerry Glover*

In order to begin detailing indicators and metrics across the domains and scales, one example from each domain was tested in a “flash fill” exercise. Discussion for each indicator focused on tradeoffs and potential solutions towards developing a minimum set of indicators that meet SI measurement needs of the development community.

*Group Discussion, Flash Fill*

* *Productivity Domain:*  The framework needs to clearly define productivity versus production. Metrics are also dependent on context/landscape/crop. For example, metrics may be different in semi-arid versus hot and humid environments, and each crop has different productivity levels. Yield gaps, gross margin and gross margin variability may be appropriate because they use the same metrics and are widely understood/have set definitions. It is important to remain focused on what to measure for identifying productivity, rather than what is important forproductivity.
  + *Crop yield*: We might have a generic indicator and sub-indicators. Is this a good way to approach this?
  + *Yield gap:* Indicators itself might not be as interpretable as yield gap
  + *ANPP of croplands*: Indicates long-term productivity
  + *Policy connections:* Production is of interest to government officials.
* *Economic Domain:* Gross margin in generally acceptable for measuring economic indicators, though profitability may be an angle to explore.
* *Environment Domain:* Environment is thorny domain because context and scale are so important. Does SI need to include landscape level for environmental impact or remain focused on sustainable practices that lead to environmental benefits?
* *Social Domain:*Social indicators need to take into consideration a range of issues; what are the minimum indicators needed in terms of measuring SI?
* *Human well-being:*In consultation with nutrition groups, it was found that that enterprise/diet diversity was the most recommended indicator across scales. Production diversity/consumption was also often cited. Is crop diversity a potential indicator for dietary diversity and nutritional quality?

**Indicator Development 2: Small group exercise**

The flash-fill exercise provided an example for small groups to follow for developing indicators and metrics. Each group did “deep dive” for each SI domain across the scales. See Annex 1 for the final tables.

*Group Discussion, small group exercise*: Are we meeting the minimum indicators and metrics needed to measure SI? What indicators and/or metrics are missing? What indicators and/or metrics can be left behind?

* The minimum framework may not meet the needs of all projects, while a “platinum level” framework may be too much for most projects to manage. The level of effort needs to synch with *sufficient* indicators and metrics for measuring SI in a harmonized way.
* The final indicators and metrics will depend on the cost of data collection methods, tools, and implementation (enumerators, equipment needs, training needs, etc.).
* Research innovations in products (genetic materials, planting materials, inputs, etc.) and processes (farming practices implemented at the farm-level) need to reflect in SI, particularly in productivity and environment indicators.
* How do we capture lessons already learned for measuring SI (e.g. interventions from the past 40 years are well-documented)?
* Information flows and application of indigenous knowledge may be an additive way to monitor SI (e.g. social network and/or stakeholder analysis).

**Next steps**

The next phase for the SI framework is to vet it with other professionals and communities of practice. Stakeholder review will improve the indicators and metrics while simultaneously establishing buy-in. The framework needs to be written-up with an emphasis on what it does and does not measure. Multiple journals are interested in publishing the framework, though it needs to be more fully developed and tested through a managed process. The specific next steps include:

* Develop a Request for Applications (RFA) that outlines a management process, including a Steering Committee and potentially one-two graduate students for further developing and testing the SI framework. It may be best tested through ongoing projects such as Africa RISING.
* Develop outputs from the workshop and develop a step-by-step process for knowledge management for introducing the framework to a wider audience.
  + Wiki’s: Low cost but require strong facilitation and management.
  + Communities of Practice: Interactive information exchange that also requires strong initial management to establish.
  + M&E: Presentations at different COPs and conferences?
  + Electronic meetings/ e-discussions:Less time bound for integrating feedback, and require deadlines and a central management point.
* The group agreed that in order to move the framework forward, a central management point is needed, and the RFA is the best way to do that. (Sustainable Intensification Feed the Future Innovation Lab will develop next steps with Jerry). Additionally, Knowledge Management is needed for sharing and advancing the framework (Feed the Future Knowledge Driven Agricultural Development project will develop next steps with Jerry).

**Productivity**

The focus in on yield, partitioned by species and tissue type, in kg/ha/season and year. In previous discussions, post-harvest loss was included to examine total productivity on and on-farm. At a minimum, a better standard for measuring productivity is needed, especially for research projects, and may best be examined by partition among crops to have commodity specific measures of yield. Additionally, adoption needs to happen before productivity can occur, as well as for measuring SI.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Field/plot (NPP) | Farm | Household | Community & National\* |
| NPP (partitioned by species and tissue type) | Yield / input  kg / ha / season  kg /ha / year |  |  |  |
| Land productivity (partitioned by species and tissue type) -- | NPP.  kg / ha / season  kg / ha / year \*\* | Value / farm / year (aggregated in dollars, or local currency, to allow for substitution of crops) | Value / person / year | % farmers adopting SI practices |
| Yield variability (over time and space) | Representative sample (for calculating coefficient of variability, distribution, etc.) | Representative sample (for calculating coefficient of variability, distribution, etc.) | Representative sample (for calculating coefficient of variability, distribution, etc.) | % farmers adopting SI practices |

\*\* Derive protein and calories from these other forms of value, and comparing across different species.

**Economic**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Field/plot | Farm | Household | Community & National\* |
| Factor Productivity (Efficiency) | Returns to land/labor/or animals: Currency/”unit”  **√** | Returns: currency/farm | Returns: currency/HH | (Resilience approach)  ∑Hholds -> relative difference across farms/hholds |
| P(<critical threshold)  (risk, equity) | Yield Risk, Livestock mortality: Probability histogram | Prob  Gross Revenues <threshold: P | Prob  Gross Revenues <threshold: P | Prevalence within community of Hh < critical level  **√** |
| Distribution of benefit by wealth (equity) |  |  |  | Distribution of incremental benefits by farm/size: Histogram  **√** |
| Poverty Reduction (equity) |  |  |  | Ag or rural wage/staple food price: index  **√**  Hh expenditure |

The focus is on productivity, risks, and equities rather than gross margin, gross margin variability, and total factor productivity.

**Note: FtF Indictors are marked with a √ in the upper right hand corner.**

**Environment**

Each indicator is dependent on scale and time, and need to remain simple despite the potential losses in nuance in remaining simple. The indicators can be specified per context. Generally, the percent cover and percent tree cover are inclusive of each level despite needing slightly different metrics between farm and field. They are inclusive of both perennials and non-perennials. As scales increase, species diversity is of greater concern.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Field/plot | Farm | Household | Community & National\* |
| Vegetative Cover | %land cover and %tree cover per year | %land cover and %tree cover per year | N/A | %land cover and %tree cover per year (landscape in this context) |
| Plant Biodiversity | #species  Shannon Diversity  And %cover of noxious plants | #species  Shannon Diversity And %cover of noxious plants | N/A | #species: rare conservation, native species |
| Water availability | Crop per drop |  |  | % unmet demand (litres per capita) |
| GHG Emissions | CO2 equivalents per dollar. | CO2 equivalents per ton. | N/A | CO2 equivalents per hectare. |
| Nutrient Balance | Kg NPK per hectare per year | Kg NPK per hectare per year | N/A | Kg NPK per hectare per year |

**Social**

The focus depends on the definitions of each indicators despite that the social indicators look at the impact of SI is *for* gender equality. For example, the goal is to evaluate if SI improves women’s access and use of resources in ways that improve their household and community decision-making power. However, evaluating such a relationship still require definitions of terms such as equity. It may be important to finalize the social theory of change for SI to finalize indicators.

\* Disaggregated by gender, age, ethnic background at HH level and Community/National

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Field/plot | Farm | Household\* | Community & National\* |
| Equity | Access production factors | Perceived Labor expended | \*Control of products (income) | What is the variability and distributions disaggregated by gender and age |
| Level of collective action |  |  |  | # of collective groups e.g Village eco regulations/  Conflict resolution measures |
| Knowledge exchange & extensions |  |  | Where do you get this info? From Hrs training / person? |  |

**Human Indicators**

For the human domain, population level data is possible across households and communities, through census style survey. Farm-level data collection is possible if using the same collection tools towards the same measures and indicators. Basic assumptions: Availability of diverse foods 🡪 Equitable Access (at markets)🡪 Uptake of nutrients (level of disease and health e.g. suffering from worms or aflatoxins then can’t take in nutrients).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Field/plot | Farm | Household\* | Community & National\* |
| Nutrition | Diversity of crops grown(disaggregated by consumption versus sale)  G protein / ha | Availability of diverse food crops  KG protein / farm | Access  Dietary diversity/ rate of stunting and wasting.  KG Consumed protein / person (diss by gender and age)  Uptake of essential nutrients | Dietary Diversity/ rate of stunting and wasting.  KG Consumed protein / person (diss by gender and age)  Market supply of diverse food |
| Food security | Calories/ ha | Kilo calories/farm | Income  Duration of food reserves  Post-harvest losses | Food production  Food reserves  Infrastructure (e.g. warehousing, access to markets/roads, irrigation; dependent on geography)  Enabling trade policies |
| Labor productivity | $/ hour  Working conditions (safety) | $/ hour  Working Conditions (safety) | Average $800/day  Measure of well-being/happiness  Amount of remittances | % of population engaged in labor  Amount of remittances  % of workforce migrating intra-nationally and internationally |

\* Disaggregated by gender, age, ethnic background at HH level and Community/National